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(54) Title of the Invention: Method of surface treatment, and method of packaging, of electrode portion of biological inductive electrode

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Specification

1. Title of the Invention

Method of surface treatment, and method of packaging, of electrode portion of biological inductive electrode

2. Calims

(1) A method of surface treatment of a biological inductive electrode, in which, after performing barrel finishing in order to remove, using synthetic stones the burrs formed in the electrode portion of a biological inductive electrode of nickel silver when it is formed by drawing into the required shape, said electrode portion with said burrs removed is subjected to ultrasonic cleaning in an alkaline solution, and at the same time another electrode is provided in the alkaline solution to perform electrolytic degreasing; the electrode portion, thus subjected to ultrasonic cleaning and degreasing by electrolysis, is immersed in a pickling [Tr's note: "Pickling" is used for Japanese term of "*kirinsu*".] liquid formed by mixing sulfuric acid and nitric acid, to remove oxides formed on the electrode portion; and after again performing ultrasonic cleaning and electrolytic degreasing in an alkaline solution, buff polishing is performed with a cloth on that part of the electrode portion of the biological inductive electrode which does not make contact with the skin surface of the living body, and hairline polishing [Tr's note: "Hairline polishing" is not used in English. It seems to mean a very light polishing.] is performed on that part which does make contact with the skin surface, to remove impurities.

(2) A method of packaging the electrode portion of a biological inductive electrode, in which, after performing barrel finishing in order to remove, using synthetic stones, the burrs formed in the electrode portion of a biological inductive electrode of nickel silver when it is formed by drawing into the required shape, said electrode portion with said burrs removed is subjected to ultrasonic cleaning in an alkaline solution, and at the same time another electrode is provided in the alkaline solution to perform electrolytic degreasing; the electrode portion, thus subjected to ultrasonic cleaning and degreasing by electrolysis, is immersed in a pickling liquid formed by mixing sulfuric acid and nitric acid, to remove oxides formed on the electrode portion; after again performing ultrasonic cleaning and electrolytic degreasing in an alkaline solution, buff polishing is performed with a cloth on that part of the electrode portion of the biological inductive electrode which does not make contact with the skin surface of the living body, and hairline polishing is performed on that part which does make contact with the skin surface, to remove impurities; [the inductive electrode] is then placed in a resin bag, and the opening of the bag is sealed by fusion.

3. Detailed Description of the Invention

Industrial Field of the Invention

The present invention concerns a method of surface treatment, and method of packaging, of the electrode portion of a biological inductive electrode, and more specifically, a method for surface treatment by the degreasing, oxide removal, and polishing of the electrode portion of a biological inductive electrode, and a method for sealing and packaging the electrode portion of a biological inductive electrode subjected to the above method of surface treatment.

Prior Art

Electrocardiograms taken using electrocardiographs are currently in wide use clinically as an indispensable source of biological information for the examination and diagnosis of cardiac disease.

Examples of a cardiogram examination include group medical examinations in which large numbers of children and students attending school are examined, and examinations employing cardiographs for automatic diagnoses. In such examinations, in order to quickly and accurately measure and record the electrocardiogram of the patient, in addition to the performance of the electrocardiograph, the performance of the inductive electrode must also be sufficient.

In order to obtain an accurate electrocardiogram quickly, it is desirable that the electrode voltage arising from the electrode portion itself of a biological inductive electrode applied to the limbs or chest area become stable immediately after fastening to the patient.

In order to reduce the contact resistance between the electrode portion of such a biological inductive electrode and the patient, a saline solution has been applied to the skin surface before attaching the electrode portion to the wetted skin surface.

Consequently the electrode voltage is stable with respect to time [due to] the saline solution, and moreover an electrode portion of nickel silver (an alloy of copper, zinc and nickel), which has excellent corrosion resistance, is widely used.

The electrode portion of this nickel silver biological inductive electrode is formed by drawing into the shape of the limbs, or the shape of the chest, from a nickel silver plate.

However, in such a molded inductive electrode, burrs may form on the surface in the drawing process, grease may adhere, or oxides may be formed on the surface of the inductive electrode.

Such grease and oxides are inexpedient in that the time characteristics of the electrode voltage of the inductive electrode are markedly degraded.

Hence conventional biological inductive electrodes had to be subjected to surface treatment in order to remove grease and oxides adhering to and forming on the surface of the electrode portion.

An example of a conventional method of surface treatment is explained. As shown by the flow chart of Fig. 8, in a method of surface treatment of the electrode

portion of a conventional biological inductive electrode, first barrel finishing is performed to remove burrs [occurring] in draw-molding of the electrode, using iron spheres and synthetic resin spheres; then, degreasing is performed by ultrasonic cleaning in an alkaline solution. After this, a cloth is used in buff polishing of parts which do not make contact with the skin, and hairline polishing is used for parts which make contact with the skin surface. This series of surface treatments is performed, in order that grease or similar impurities which impede the time characteristics of the voltage between electrodes, which for nickel silver is inherently stable, do not remain on the surface of the electrode portion.

Problems to be Solved by the Invention

Although this treatment can be used to remove grease, it is difficult to remove oxides which impede the electrode voltage, and powder of the iron spheres used in barrel finishing adhere to the electrode and adversely affect the electrode voltage, so that an electrode portion with adequate characteristics could not be obtained.

Hence the time characteristics of the electrode voltage of the electrode portion thus obtained becomes unstable, as shown by the curve in Fig. 9, when measured with saline solution using a silver-silver chloride electrode as a reference electrode, so that it is difficult to obtain a prompt and accurate electrocardiogram.

In order to remove the effect of oxides and obtain a stable electrode portion, another method is required of the user, such as immersion for approximately 24 hours in saline solution, to form chlorides of copper on the electrode portion surface; this is troublesome for the user, and incurs the further problem of a reduced product value as the color changes to a faint black color.

The present invention has as an object the resolution of the problems that using the conventional method, the oxides on the electrode portion surface of a biological inductive electrode cannot be adequately removed, that the user is required to perform a secondary supplementary task, and that the beauty of [the product] is degraded.

Means to Solve the Problems

In order to achieve the above object, the present invention provides the following method of surface treatment and a method of packaging the electrode portion of a biological inductive electrode. That is, the present invention is a method of surface treatment of a biological inductive electrode, in which, after performing barrel finishing in order to remove, using synthetic stones, the burrs formed in the electrode portion of a biological inductive electrode of nickel silver when it is formed by drawing into the required shape, said electrode portion with said burrs removed is subjected to ultrasonic cleaning in an alkaline solution, and at the same time another electrode is provided in the alkaline solution to perform electrolytic degreasing; the electrode portion, thus subjected to ultrasonic cleaning and degreasing by electrolysis, is immersed in a pickling liquid formed by mixing sulfuric acid and nitric acid, to remove oxides formed on the electrode portion; and after again performing ultrasonic cleaning and electrolytic degreasing in an alkaline solution, buff polishing is performed with a cloth on that part of the electrode portion of the biological inductive electrode which does not make contact with the skin surface of the living body, and hairline polishing is performed on that part which does

make contact with the skin surface, to remove impurities; and, a method of packaging in which [an inductive electrode] which has been subjected to this surface treatment is then placed in a resin bag, and the opening of the bag is sealed by fusion.

Operation

In the above configuration, synthetic stones are used in the barrel finishing process to remove burrs formed during drawing to mold the electrode portion of the biological inductive electrode, and the electrode portion surface is polished.

In the ultrasonic cleaning and electrolytic degreasing process, degreasing is performed by ultrasonic cleaning of the biological inductive electrode in an alkaline solution, and at the same time another electrode is provided and a voltage applied to perform electrolytic degreasing.

In the pickling liquid immersion process, oxides are removed using a pickling liquid which is a mixture of sulfuric acid and nitric acid.

By again performing ultrasonic cleaning and electrolytic degreasing, oxides and adhering matter remaining in the above process of immersion in a pickling liquid are removed.

In the buff polishing process, a cloth to produce luster is used to polish that part of the electrode portion of the biological inductive electrode which does not make contact with the skin surface of the living body, and in the hairline polishing process, impurities on the portion which makes contact with the skin surface of the living body are removed, and the appearance of the electrode portion of the biological inductive electrode is improved.

The sealing and packaging prevents contact of the electrode portion surface with the outside air and with the hands of other persons until [the package] is opened.

Embodiments

Embodiments of this invention are explained below, referring to the drawings, to describe actual application of the invention.

Fig. 1 is a flowchart used to explain the method of the invention. First, the electrode portion of a nickel silver biological inductive electrode, drawn into the required shape, and synthetic stones are mixed in a tube to perform barrel finishing, removing any burrs or similar occurring in the drawing or other processes.

There are, as biological inductive electrodes, bowl-shaped inductive electrodes for the chest, which are fastened on the chest area, clip-type electrodes for the limbs, which are fastened on the arms or legs, and various other shapes; of these, Fig. 2 shows one example of an electrode for the limbs. The electrode portion 2 is fastened to the clip-shape main unit 1, and this main unit 1 encloses the arm or leg through the elastic force of a spring 3, causing the electrode portion 2 to be in contact with the skin, extracting the electrocardiograph current arising from the activity of the heart outside the body, and enabling measurement by an electrocardiograph (not shown) connected to a lead wire 4 installed on the electrode portion 2.

This electrode portion 2 is first drawn into a shape like that shown in Fig. 3, and then various surface treatment methods are used to reduce the contact resistance.

In the barrel finishing process of Fig. 1, synthetic stones are used in order to remove burrs and at the same time to polish the electrode portion surface; in the conventional method using iron spheres, iron molecules adhered to the electrode portion surface, having an adverse effect, and so in this invention synthetic stones are used.

Next, ultrasonic cleaning and electrolytic degreasing are performed simultaneously in an alkaline solution.

In other words, in addition to the degreasing process by ultrasonic cleaning of the prior art, another electrode is provided in the alkaline solution, a DC voltage is applied, and impurities are attracted to the side of the other electrode. This is done in order to perform more powerful and effective degreasing by means of electrolytic degreasing.

Following this degreasing process, the electrode portion of the biological inductive electrode is immersed in a pickling liquid, which is a mixture of sulfuric acid and nitric acid, to perform acid washing of the electrode surface, and dissolve and remove oxides. At this time, in addition to oxides, the surface metal is also dissolved to some extent to expose the base metal.

After removing oxides in this way, ultrasonic cleaning and electrolytic degreasing are again performed.

This is performed in order to once more scrupulously remove impurities remaining or adhering in the above process of oxide removal using a pickling liquid.

In the following buff polishing process, of the above electrode portion, that part which does not make contact with the skin surface of the living body is polished by mounting a cloth with a polishing agent on a disc and rotating [the disc], in order to add a luster to the metal surface and improve the appearance. In the final hairline polishing process, numerous wires are mounted on a disc, and the disc is rotated to perform polishing; of the above electrode portion, that part which makes contact with the skin surface of the living body [is polished] to finally remove adhering matter and at the same time improve the appearance.

The time characteristics of the electrode voltage of the electrode portion of a biological inductive electrode subjected to surface treatment by this method are more quickly stabilized, when measured in saline solution using as the reference electrode a silver-silver chloride electrode, as shown in Fig. 4.

Consequently measurement operations can be performed more quickly, so that group medical examinations and other examinations of numerous persons can be performed efficiently.

Further, if there is poor storage and management during the period until use by a physician or other user, there may be degradation of the time characteristic of the electrode voltage of the electrode portion of a biological inductive electrode prepared in this way, and moreover the appearance may be worsened, reducing the product value. Hence in this invention, as shown in the flowchart of Fig. 5, the electrode portion 2 of a

biological inductive electrode subjected to surface treatment by the above-described processes is placed in a bag 5 of vinyl or other resin as shown in Fig. 6, and the opening 6 is fused and sealed by ultrasound or other means, to prevent contact with the outside air and with the hands of other persons.

Placement in the resin bag 5 may also be performed after completion as a product of the biological inductive electrode, as in Fig. 7.

Advantageous Result of the Invention

By means of the above invention, synthetic stones are used in barrel finishing, so that not only are burrs occurring during the shaping of the electrode portion of the biological inductive electrode removed, but polishing of the electrode portion surface can also be performed simultaneously, there is no adhesion of iron molecules to the electrode portion surface as when using conventional iron spheres, and barrel finishing becomes more effective.

Also, degreasing by ultrasonic cleaning in an alkaline solution is performed simultaneously with electrolytic degreasing using another electrode, so that the degreasing process is performed more effectively, and the degreasing effect is improved.

Further, acid washing of the above electrode portion surface is performed by immersion in a pickling liquid formed by mixing sulfuric acid and nitric acid, so that oxides can be removed.

In addition, ultrasonic degreasing in an alkaline solution is again performed simultaneously with electrolytic degreasing, so that electrode portion surface impurities remaining or adhering during the above oxide removal can be scrupulously removed.

Moreover, buff polishing with a cloth is performed on that part of the biological inductive electrode which does not make contact with the skin surface of the living body, to increase luster and improve appearance.

At the same time, hairline polishing is performed on that part of the electrode portion of the biological inductive electrode which makes contact with the skin surface of the living body to finally remove impurities, optimizing the electrical characteristics of the electrode portion, and improving appearance to enhance the product value.

Through these processes, degreasing and oxide removal are thoroughly performed, so that secondary processing performed by the user, such as immersion for 24 hours in saline solution, becomes unnecessary, and convenience for the user is improved.

Also, by means of this method impurities are thoroughly removed, so that the electrode voltage stabilizes quickly during use, and consequently examinations of numerous persons, such as in group medical examinations, can be performed quickly.

Further, by inserting the electrode portion of a biological inductive electrode prepared in this manner in a resin bag and sealing, [the electrode portion] is isolated and protected from contact with the outside air or the hands of other persons, and from adherence of impurities, until being opened by the physician or other user, so that there is the advantage of maintaining the optimum state as a product, both functionally and in terms of appearance.

4. Brief Description of the Drawings

Fig. 1 is a flowchart of the method of surface treatment of the electrode portion of a biological inductive electrode of this invention; Fig. 2 is a perspective view of a biological inductive electrode; Fig. 3 is the electrode portion of a biological inductive electrode; Fig. 4 is a figure showing the electrical characteristics of the electrode portion of a biological inductive electrode of this invention; Fig. 5 is a flowchart showing the method of surface treatment and of sealing and protection; Fig. 6 is a figure showing insertion [in a bag] of the electrode portion; Fig. 7 is a figure showing insertion [in a bag] of an electrode, with the electrode portion installed; Fig. 8 is a flowchart of a method of treatment in an example of the prior art; and Fig. 9 is a figure showing the electrical characteristics of the electrode portion of a biological inductive electrode in an example of the prior art.

1: Main unit of a biological inductive electrode

2: Electrode portion

3: Resin bag

4: Opening

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Figure 1

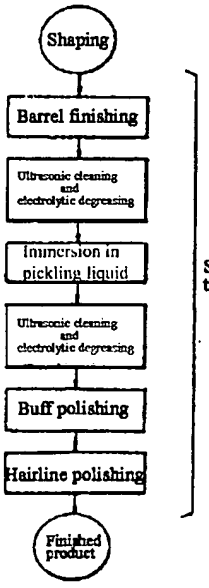


Figure 2

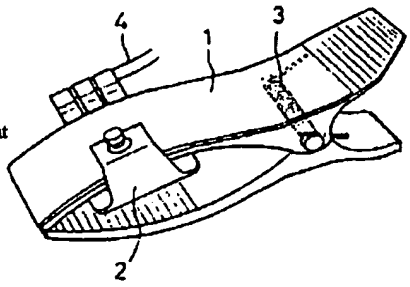


Figure 3

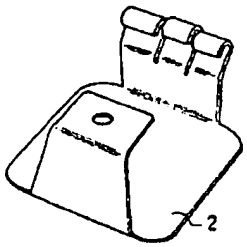


Figure 4

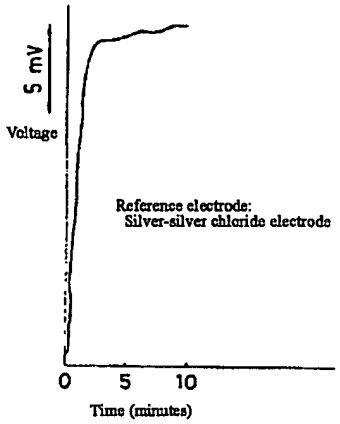


Figure 5

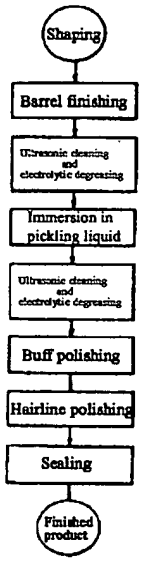


Figure 6

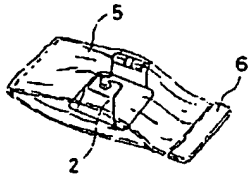


Figure 7

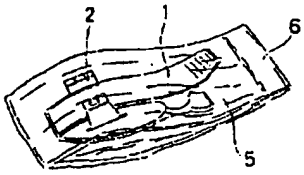


Figure 8

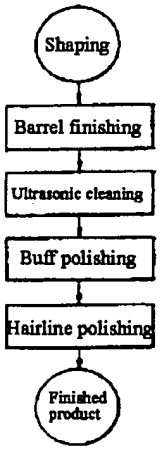
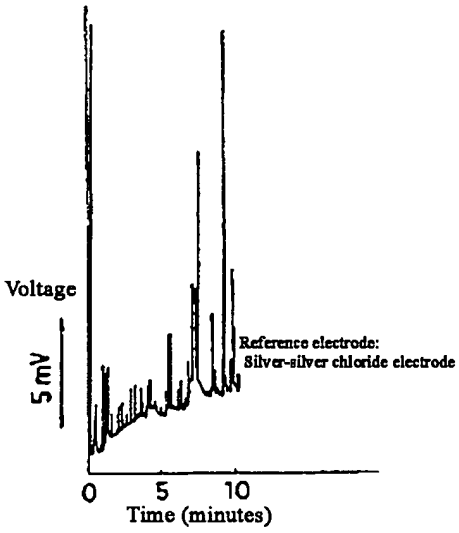


Figure 9



⑲日本国特許庁（JP）　⑪特許出願公開

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審査請求　有　発明の数 2　（全6頁）

㊹発明の名称　生体用誘導電極の電極部の表面処理方法および包装方法

㉑特　願　昭61－199455

㉒出　願　昭61(1986)8月26日

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明　細　書

1．発明の名称

生体用誘導電極の電極部の表面処理方法および包装方法

2．特許請求の範囲

(1) 必要な形状に型抜きされた洋白製の生体用誘導電極の電極部に前記型抜きに伴って形成されたバリを、人工石で除去するためのバレル仕上げをしたあと、前記バリを除去した前記電極部をアルカリ溶液で超音波洗浄を行うと同時にこのアルカリ溶液中に他の電極を設けて電解脱脂を行い、このように超音波洗浄と電解による脱脂を行った電極部を、硫酸と硝酸を混合してなるキリンス液に浸漬して電極部に形成されている酸化物を除去し、再びアルカリ溶液中で超音波洗浄と電解脱脂を行った後、この生体用誘導電極の電極部のうち、生体の皮膚面に接触しない部分には布を用いたバフ研磨を施し、皮膚面に接触する部分にはヘアライン研磨を施すことにより不純物を除去する、生体用誘導電極の表面処理方法。

(2) 必要な形状に型抜きされた洋白製の生体誘導電極の電極部に前記型抜きに伴って形成されたバリを、人工石で除去するためのバレル仕上げをしたあと、前記バリを除去した前記電極部をアルカリ溶液中で超音波洗浄を行うと同時にこのアルカリ溶液中に他の電極を設けて電解脱脂を行い、このように超音波洗浄と電解による脱脂を行った電極部を、硫酸と硝酸とを混合してなるキリンス液に浸漬して電極部に形成されている酸化物を除去し、再びアルカリ溶液中で超音波洗浄と電解脱脂を行った後、この生体用誘導電極の電極のうち、生体の皮膚面に接触しない部分には布を用いたバフ研磨を施し、皮膚面に接触する部分にはヘアライン研磨を施すことにより不純物を除去したものを、樹脂製の袋に収納し、その袋の開口部を溶着密封してなる、生体用誘導電極の電極部の包装方法。

3．発明の詳細な説明

〔産業上の利用分野〕

本発明は生体用誘導電極の電極部の表面処理方法および包装方法に関し、より詳しくは生体用誘導電極の電極部の脱脂、酸化物除去、研磨による表面処理方法、およびこの方法によって表面処理を施した生体用誘導電極の電極部を密封包装する方法に関するものである。

〔従来の技術〕

心電計による心電図は心臓病を検査診断する上で、欠かせない生体情報の一つとして現在臨床上ひろく使用されている。

心電図検査の例としては就学中の児童、生徒を多量に検査する集団検診や、自動診断用心電計を使用しての検査があるが、これらの検査においては被検者の心電図を正確に迅速に検査収録するためには、心電計の性能もさることながら誘導電極の性能が十分でなければならない。

迅速に正確な心電図を得るためには、四肢および胸部にとりつけられる生体用誘導電極の電極部自身から発生する電極間電圧が被験者に装着してから時間的にみて直ちに安定していることが望ましい。

このような生体用誘導電極の電極部は被着される人体との間に接触抵抗を少なくするため、食塩水を皮膚面に塗布してから、その塗布面に電極部を被着していた。

そのため食塩水に対して電極間電圧が時間的に安定しており、かつ、耐蝕性に優れた洋白（銅、亜鉛、ニッケルの合金）製の電極部が広く使用されている。

この洋白製の生体用誘導電極の電極部は洋白板から四肢用、または胸部用の形状に型抜き成型される。

ところでこのように成型された誘導電極は、型抜き工程において誘導電極の表面にバリが発生したり油脂が付着したり酸化物が生成したりする。

この油脂や酸化物は誘導電極の電極間電圧の時間特性を著しく悪化させるという不都合があった。

そのため従来の生体用誘導電極はこの電極部の表面に付着成型された油脂や酸化物を除去するために表面処理を施さなければならなかった。

その表面処理方法の従来例を説明すると、従来の生体用誘導電極の電極部の表面処理方法は、第8図のフローチャートで示すように、まず、鉄球と合成樹脂球により電極の型抜き成型時のバリを除去するバレル仕上げを行い、次にアルカリ溶液中における超音波洗浄による脱脂を行った後、皮膚と接触しない部分については布を用いたバフ研磨を施し、皮膚面に接触する部分にはヘアライン研磨を行う。という一連の表面処理を施し、洋白自身が有する安定した電極間電圧の時間特性を阻害する油脂などが電極部表面に残留しないようにしていた。

〔発明が解決しようとする問題点〕

しかしこの処理では油脂を除去することは可能であるが、電極間電圧を阻害する酸化物を除くことは困難であり、またバレル仕上に使用する鉄球の粉末が電極に固着して電極間電圧に悪影響を与えていて、電極部として十分な特性を得ることが出来なかった。

そしてここで得られた電極部の電極間電圧の時間特性は、銀－塩化銀電極を参考電極として食塩水で測定すると第9図の曲線で示すように不安定なものとなり、正確で迅速に心電図を得ることは困難である。

そのため、酸化物の影響を除いて安定な電極部にするためには従来、ユーザ側において食塩水に24時間程度浸漬し、電極部表面に銅の塩化物を形成するなど別の方法が必要となるが、これはユーザ側にとって煩わしく、また緑黒色に変化して商品価値が低下するので好ましく無いという問題がある。

本発明はこのような従来の方法では生体用誘導電極の電極部表面の酸化物を十分に除去することができないことと、また、ユーザ側における2次的な補完作業を要するという問題点、さらには美観を損ねるという問題点を解決することを目的とする。

〔問題点を解決するための手段〕

上記目的を達成するため、本発明は次ぎのような生体用誘導電極の電極部の表面処理方法および包装方法を提供する。すなわち本発明は、必要な形状に型抜きされた洋白製の生体用誘導電極の電極部に前記型抜きに伴って形成されたバリを、人工石で除去するためのバレル仕上げをしたあと、前記バリを除去した電極部をアルカリ溶液中で超音波洗浄を行うと同時にこのアカリ溶液中に他の電極を設けて電解脱脂を行い、このように超音波洗浄と電解による脱脂を行った電極部を、硫酸と硝酸とを混合してなるキリンス液に浸漬して電極部に形成されている酸化物を除去し、再びアルカリ溶液中で超音波洗浄と電解脱脂を行った後、この生体用誘導電極の電極部のうち、生体の皮膚面に接触しない部分には布を用いたバフ研磨を施し、皮膚面に接触する部分にはヘアライン研磨を施すことにより不純物を除去する、生体用誘導電極の表面処理方法、および、このようにして表面処理されたものを樹脂製の袋に収納し、その袋の開口部を溶着密封してなる、生体用誘導電極の電極部の包装方法である。

〔作　用〕

前記構成においてバレル仕上げの工程では人工石により、生体用誘導電極の電極部成型の型抜きの際発生したバリを除去するとともに電極部表面を研磨する。

超音波洗浄および電解脱脂工程ではアルカリ溶液中で生体用誘導電極の超音波洗浄による脱脂を行うとともに他の電極を設けて電圧を印加し電解脱脂を行う。

キリンス液浸漬の工程では、硫酸と硝酸の混合液、キリンス液で酸化物を除去する。

さらに再び、超音波洗浄および電解脱脂を行うことにより前記キリンス液中浸漬の工程での残留した不純物、付着物を除去する。

バフ研磨の工程では、光沢をだすため布を用いて生体用誘導電極の電極部のうち、生体の皮膚面に接触しない部分を研磨し、ヘアライン研磨の工程では生体の皮膚面に接触する部分の不純物を除去し、生体用誘導電極の電極部の見栄えを良くする。

密封包装はユーザが開封するまでは外気や第三者の手が電極部表面に触れることを防ぐ。

〔実施例〕

本発明の実施例について、以下図面にしたがって本発明がどのように具体化されるかを説明する。

第1図は本発明の方法を説明するためフローチャートで、まず必要な形状に成型した洋白製の生体用誘導電極の電極部と人工石を篭の中で攪拌させてバレル仕上げを行い、型抜きなどの際に生じたバリなどを除く。

ここで、生体用誘導電極には胸部にとりつけるおわん型の胸部用誘導電極、腕や脚にとりつけるクリップ型の四肢用電極などがあり、形状もさまざまであるが、その中の四肢用電極の一例を図示すれば第2図のとおりで、クリップ状の本体1に電極部2が取り付けてあり、この本体1はバネ3の弾力で腕や脚を挟み、電極部2を皮膚に接触させ、心臓の活動に伴って発生する心電流などを体外にとりだし、電極部2に取り付けてあるリード線4を心電計（図示せず）に接続して測定するものである。

この電極部2は、まず第3図に示すような形状に型抜きされた後、接触抵抗をより少なくするなどのために種々の方法で表面処理が行われるのである。

第1図のバレル仕上げの工程で人工石を用いたのは、バリ取りと同時に電極部表面に研磨を施すためであり、従来の鉄球を用いる方法では鉄の分子が電極部表面に付着し、悪影響を及ぼすので本発明では人工石とした。

次ぎに、アルカリ溶液中で、超音波洗浄および電解脱脂を同時に行う。

すなわち従来の超音波洗浄による脱脂工程のほかに他の電極をこのアルカリ溶液中に設け、直流電圧を印加し、その設けた他の電極側に不純物を吸引する。これは電解脱脂により脱脂工程をより

強力に、より効果的に施すためである。

この脱脂工程の次ぎは、硫酸と硝酸の混合液で、あるキリンス液に生体用誘導電極の電極部を浸漬して電極表面の酸洗いを行い酸化物を溶かして取り除く工程である。このとき酸化物のほか、表面の金属も若干溶かし金属の生地をあらわすこととなる。

こうして酸化物を除去したあと、再度超音波洗浄と電解脱脂がおこなわれる。

これは前記キリンス液を用いた酸化物除去の工程で残留あるいは付着した不純物をもういちど念入りに取り除くためのものである。

その次ぎのバフ研磨工程は、前記電極部のうち、生体の皮膚面に接触しない面の金属面の光沢を出し見栄えをよくするために研磨剤付の布を円盤に取り付け、回転させて行う研磨であり、さらに最後のヘアライン研磨工程は円盤に多数の針金を取り付けて回転させて研磨するもので、前記電極部のうち、生体の皮膚面に接触する面について最終的に付着物を除去し、同時に見栄えを良くするものである。

このような方法で表面処理された生体誘導電極の電極部の電極間電圧の時間特性は、銀－塩化銀電極を参考電極として食塩水中で測定すると第4図のように早く安定したものとなる。

そのため、測定操作が迅速にでき、集団検診など多人数の検診が効率的に実施できる。

さらに、このようにしてできた生体用誘導電極の電極部も、ユーザである医師などが使用するまでの間の保管管理が悪いと電極間電圧の時間特性の劣化につながり、かつ、見栄えが悪く商品価値が低下するので、本発明では第5図のフローチャートで示すように、前述の工程により表面処理された生体用誘導電極の電極部2を第6図のようにビニールなどの樹脂製の袋5に収納して開口部6を超音波などにより溶着密封して外部の空気や第三者の手に触れるのを防止する。

なお、樹脂製の袋5への収納は第7図のように生体誘導電極の完成品としてもよい。

〔発明の効果〕

以上本発明によれば、人工石を用いてバレル処理を行うので生体誘導電極部の電極部の成型時にできたバリを除去できるだけでなく、電極部表面研磨も同時に行えることと、従来の鉄球を用いたときのような鉄の分子が電極部表面に付着するおそれがなくなり、バレル仕上げが一層効果的になる。

また、アルカリ溶液中で、超音波洗浄による脱脂と同時に他の電極を用いて電解脱脂を行うこととしたので脱脂工程がより効果的に行われ、脱脂効果が向上する。

さらに、硫酸と硝酸を混合してなるキリンス液に浸漬して前記電極部表面に酸洗いを行うので酸化物を除去することができる。

加えて、再びアルカリ溶液中で超音波洗浄と同時に電解脱脂を行うので、前記酸化物除去の際残留あるいは付着した電極部表面不純物も念入りに除去することができる。

そのうえ、布によるバフ研磨により生体用誘導電極の電極部のうち、生体の皮膚面に接触しない面は光沢が増して美観が向上する。

同時に、ヘアライン研磨は生体用誘導電極の電極部のうち、生体の皮膚面に接触する面の不純物を最終的に除去し、電極部の電気的特性を最良の状態に仕上げるとともに、見栄えを良くして商品価値を高める。

このような工程を経て脱脂や酸化物除去が十分に行われるので、従来、ユーザ側で行った食塩水24時間浸漬などの2次的処理が不要となり、ユーザへのサービスが向上する。

また、このようにして不純物が十分に除去されたので、使用にあたり電極間電圧の安定が早く、集団検診などの多人数の検診を迅速に実施することができる。

さらに、このようにしてできた生体用誘導電極の電極部は、樹脂製の袋に収納して密封することにより、ユーザである医師などの手によって開封されるまで、外気や第三者の手などに触れて不純物の付着することから隔絶保護され、機能的にも

美観的にも商品として最良の状態を保つことができるなどの効果がある。

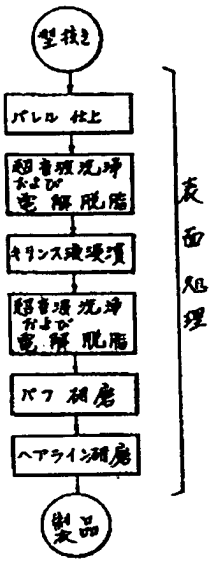
4．図面の簡単な説明

第1図は本発明の生体用誘導電極の電極部の表面処理方法のフローチャート、第2図は生体用誘導電極の斜視図、第3図は生体用誘導電極の電極部、第4図は本発明の生体用誘導電極の電極部の電気特性を示す図、第5図は表面処理とともに密封保護する方法を示すフローチャート、第6図は電極部の収納図、第7図は電極部を装着した電極の収納図、第8図は従来例の処理方法のフローチャート、第9図は従来例の生体用誘導電極の電極部の電気特性を示す図である。

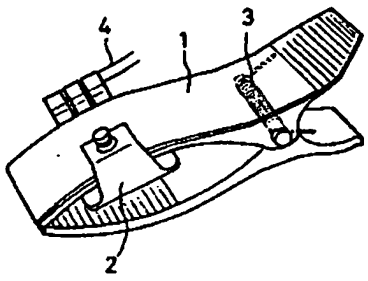
1……生体用誘導電極の本体、
2……電極部、
3……樹脂製の袋、
4……開口部。

出願人　フクダ電子株式会社　他1名
代理人弁理士　鈴木　淳也

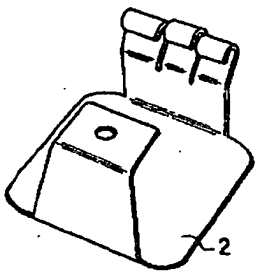
第1図



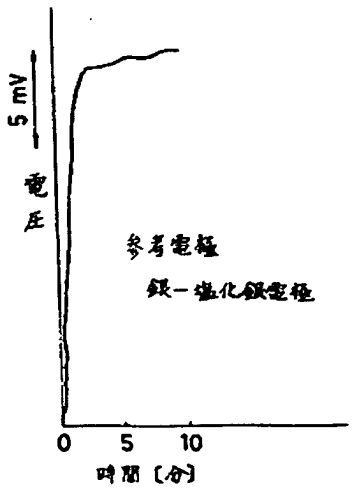
第2図



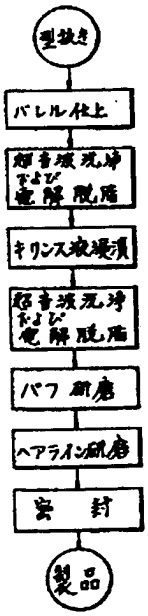
第3図



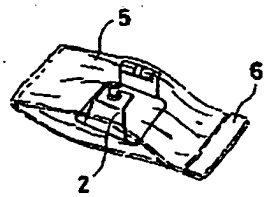
第4図



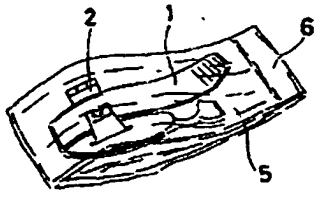
第5図



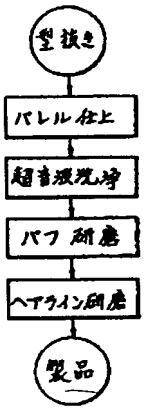
第6図



第7図



第 8 図



第 9 図